

GENERAL RULES GOVERNING SOLUBILITY OF COMMON IONIC COMPOUNDS IN WATER

The prediction of the solubility of ionic compounds is, at best, not a well developed science. Lists of solubility “rules” can be found in a variety of General Chemistry textbooks and other sources, but the lists will vary slightly from source to source because they are based primarily on qualitative observations. Thus, these lists do not cover every possible compound, but they do provide a useful means of predicting solubility for the more common ionic compounds. The list provided here is adapted from Lagowski, J. J.; Sorum, C. H. “Introduction to Semimicro Qualitative Analysis” 7th Ed., Prentice Hall, New Jersey, 1991.

In general solubility increases with increasing temperature. This table assumes 25° C.

WORKING DEFINITIONS

- **Soluble** saturated solution at least 0.1 M (≥ 100 mM)
- **Insoluble** saturated solution less than 0.001 M (≤ 1 mM)
- **Slightly soluble** saturated solution between 1 mM and 100 mM

Soluble Salts

| Form Soluble Compounds | Exceptions with | Slightly Soluble |
|--|-----------------------------------|------------------------------------|
| Group I metals and NH_4^+ | | |
| Nitrates, Chlorates, Acetates, and Dichromates | | $\text{AgC}_2\text{H}_3\text{O}_2$ |
| Chlorides, Bromides, and Iodides | Ag, Pb(II), Hg(I), HgI_2 | |
| Sulfates | Pb(II), Sr, Ba | Ag, Ca, Hg(I) |

Insoluble Salts

| Form INSoluble Compounds | Exceptions with | Slightly Soluble |
|---|---|------------------|
| Oxides and Hydroxides | Group I metals, NH_4^+ , Sr, Ba | Ca |
| Sulfides | Group I metals, NH_4^+ | Mg, Ca, Ba |
| Carbonates, Phosphates, Borates, Sulfites, Chromates, Oxalates, and Arsenates | Group I metals & NH_4^+ MgCrO_4 , MgC_2O_4 | MgSO_3 |